Review 16 Differential Equations

Diff. Eq. has a derivative in the equation

$\frac{dy}{dx} = \cos(2x)$ initial values $y(0) = 1$

Find $y(\pi)$ final value

solve the D.E. means find y

general solution $y = \frac{\sin(2x)}{2} + c$

$1 = \frac{\sin(2\cdot 0)}{2} + c \quad c = 1$

specific solution $y = \frac{\sin(2x)}{2} + 1$

If $\int_0^{\pi} \cos(2x)\,dx = y(\pi) = \frac{\sin(2\pi)}{2} + 1 = 1$

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Ex 1 show $y = ce^{2x}$ is a solution to

method I $\frac{dy}{dx} = 2y$

method II $2ce^{2x} = 2 \cdot ce^{2x}$

$\int \frac{dy}{y} = \int 2\,dx$

$e^{\ln|y|} = e^{(2x+c)}$

$y = e^{2x} \cdot e^{c} = ce^{2x}$

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Ex 2 $\frac{dy}{dx} = (10-y)x^2 \quad x=0 \quad y=1$

$\int \frac{dy}{10-y} = \int x^2\,dx$

$-\ln|10-y| = \frac{x^3}{3} + c$

$\ln|10-y| = -\frac{x^3}{3} + c$

$10-y = e^{-\frac{x^3}{3}+c}$

$10-y = ce^{-x^3/3}$

$y = 10 - ce^{-x^3/3}$

$1 = 10 - ce^{0}$

$c = 9$

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Ex 3 calc. ok

$\frac{dy}{dx} = \frac{\cos x}{x} \quad y(1) = 3$

$y(\pi) = ?$

$\int \frac{\cos x}{x}\,dx = ???$

$y(\pi) = 3 + \int_1^{\pi} \frac{\cos x}{x}\,dx = 2.736$

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